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INSECT PESTS OF COUNTRY BEAN AND THEIR RELATIONSHIPS WITH TEMPERATURE

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ABSTRACT

The study was conducted to know the insect pests attacking country bean *Lablab purpureus* plants in Sylhet Agricultural University Campus, Sylhet, Bangladesh, and to find out the relationships of the abundances of the insect pests with number of bean pods and prevailed temperature during the study period. Aphid *Aphis craccivora* (Hemiptera: Aphididae), epilachna beetle *Epilachna duodecastigma* (Coleoptera: Coccinellidae), shoot borer *Acrobasis caryae* (Lepidoptera: Pyralidae) and pod borer *Maruca testulalis* (Lepidoptera: Crambidae) were found as the insect pests of country bean plants. Aphid and pod borer showed significant positive relationship with number of pods of country bean and temperature. Abundances of ephilachna beetle and shoot borer were negatively correlated with the number of pods of the country bean.

Keywords: *Lablab purpureus,* Sylhet, temperature, yield

Introduction

Country bean *Lablab purpureus*, a leguminous crop of the sub-family Papilionaceae is a very important vegetable and pulse crop which have high nutritional value (Jayasinghe *et al.* 2015). Country bean is cultivated round of the year in Asia, but high incidence of insect pests deteriorates yield and quality of the pod. A report revealed that eighteen species of insect cause infestation on country bean field (Jayasinghe *et al.* 2015, Khan *et al.* 2019). Aphids cause damage directly by sucking cell sap of plant and indirectly by transmitting several viral diseases (Mckinlay *et a1*. 1992, Uddin *et al.* 2014). Both the nymphs and adults of bean aphid sucking sap from flowers, buds, pods and tender shoots of the plants and reduce the vitality of the bean and leguminous crops (Shrivastava and Singh 1986). Bean pod borer is able to establish itself from vegetative to reproductive stage of country bean (Khan *et al.* 2018). At the early stage of plant growth, the bean pod borer, attack the crop making clusters of leaves, tendrils and young shoots of the plant and later at flowering and pod setting stages of plants the insect feeds internally (Nazrul and Shaheb, 2016).

Phytophagous insect species and their abundance vary with geographical, locations, availability of host plants and climatic conditions of the region. Khan *et al.* (2018) observed pod borer abundance was low with high average humidity and then increased slightly due to decrease of humidity and finally declined with increasing humidity. Nitharwal and Kumawat (2009) found a significant negative correlation of jassid, whitefly and thrips with maximum temperature and positive correlation of thrips with minimum temperature. Hossain *et al.* (2009) noted that the incidence insect pests was dependent on prevailed climatic conditions of the cropping season. Considering the above fact, the present research was conducted to identify the insect pests of country bean in Sylhet region and to find out the relationships between the abundances of the prevailed insect pests with ambient temperature.

Materials and Methods

Study location and duration: The study was conducted in the field laboratory of the Department of Entomology, Sylhet Agricultural University, Sylhet, Bangladesh in winter season from 2017-2018. The area is hilly and located at 23°57′ to 25°13′ N and 90°56′ to 92°21′ E, and surrounded by Megalaya State of India.

Cultivation of bean plant: Seeds of the country bean (variety BARI sheem 1, BARI sheem 6, IPSA Seem-2 and

Goalgadda sheem) were collected from the Department of Horticulture of Sylhet Agricultural University and local market, respectively. The study was arranged in Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 3.0 m × 2.0 m accommodating single row and three pits per bed. Plant spacing was 1.0 m and 3 pits were prepared for seedling transplantation. The number of plots per treatment was three, and spaces between blocks and between plots were 0.5 m and 1.0 m, respectively. Seeds were sown on 20 October 2017 in rows. Each plot contained 1 row with 3 pits separated by 60 cm. After the emergence of seedlings, the plants were supported by bamboo sticks to facilitate creeping. The manures and fertilizers were applied according to the recommended doses of the Bangladesh Agricultural Research Institute. Mulching, weeding, irrigation, etc. were done whenever necessary. The soil of field belongs to the Khadimnagar soil series of Eastern Surma-Kushiara Floodplain under the Agroecological zones-20 (FAO, 1988).

Insect collection and identification: Insects were captured using sweeping net having 30 cm diameter ring and 1.5 mm mesh, and attached with a 2 m long rod. A vacuum suction sampler was also used to capture very small insects. Insects were collected at weekly interval from seedling to last harvest of bean. Every collection date, both sweep net and vacuum suction sampling were done 30 times. For borer pest's visual searching method were used. In every stage (vegetative, flowering and reproductive) every part of each plant viz. lower, middle and higher part four leaves was selected and observed. The collected insects were brought from the experimental field to the Entomology Laboratory of Sylhet Agricultural University and stored in a freezer for a few hours to kill, then mounted on points, dried and morphotyped. For identification, the insects were compared with the specimens in a labeled collection and compared with pictures or descriptions. The identified insects were categorized and their relative abundance were calculated.

Collection of weather data: The meteorological parameter (temperature) were collected from weather station of Sylhet town and correlated with population of country bean insect pest through Microsoft Excel Program.

Results and Discussion

The relative abundance of insect pests in country bean agroecosystem during winter season 2017-2018 presented in Table & Figure 1. The highest number of insect was aphid (55.6%) followed by pod borer (33.9%), epilachna beetle (7.8%) and the lowest number pf insect was shoot borer (2.7%). The present results of the insect pest abundance were completely supported the study of Khan *et al.* (2018) and partially similar of the finding of Jayasinghe *et al.* 2015.

Correlation study was done to establish the relationship between insect numbers with temperature in country bean field. From the Table 2, it was revealed that significantly positive correlation was observed between in aphid ($p < 0.01$) and pod borer ($p < 0.05$) and no relationship found in epilakhna beetle and shoot borer with temperature. It was evident that the equation y = 2.1034X-25.246; 1.0386 X -6.2699 gave a good fit to the data and the co-efficient of determination R^2= 0.91, 0.80 fitted regression line had a significant regression co-efficient. In case of aphid, the relationship can be explained by 91% increasing of temperature contributed to enhance the aphid population 91%. On the other hand for of pod borer, the relationship can be explained by 80% increasing of temperature contributed to enhance pod borer population 80% accordingly. The similar result observed in mungbean plant on aphid and pod borer abundance gradually increased with increasing average temperature in April to June, 2015 reported by Khan *et al.* (2018).

The study of correlation was made to establish the relationship between the yield (pod numbers) of country bean and its insects in natural condition. From the Table 3, it was revealed that significantly positive and negative

Table 1. Enlist of insect pests in country bean plot^{-1} during winter season 2017-2018

Insects	Scientific Name	Family	Order	Pests status
Aphids	*Aphis craccivora*	Aphididae	Hemiptera	Major
Epilachna beetle	*Epilachna duodecastigma*	Coccinellidae	Coleoptera	Minor
Shoot borer	*Acrobasis caryae*	Pyralidae	Lepidoptera	Minor
Pod borer	*Maruca testulalis*	Crambidae	Lepidoptera	Major

Table 2. The relationships between the abundances of the insect pests of country bean and temperature

Insect pests	Regression equation	%Role of individual factor	F value	Significance	R^2 value
Aphid	y = 2.1034X-25.246	91		P < 0.01	0.91
Pod borer	Y=1.0386 X -6.2699	80		P < 0.05	0.80
Epilachna beetle	-	-	-	Non-significant	-
Shoot borer	-	-	-	Non-significant	-

Y, insect population/trap/week; X, temperature (ºc).

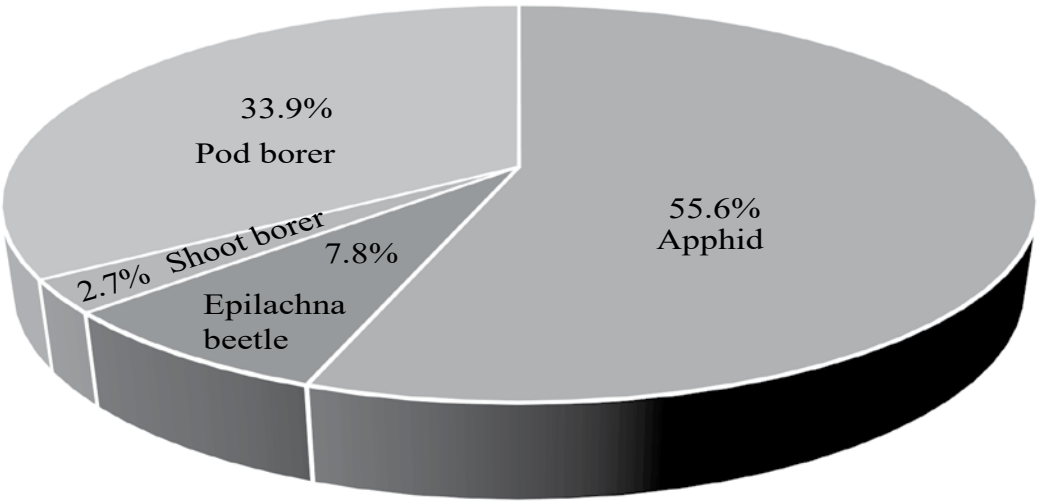

Figure 1. Relative abundance of the insect pests attacking bean plants in Sylhet during winter season

Table 3. The relationships between the abundances of the insect pests of country bean and the number of pods per plant

Insect pests	Regression equation	% Role of individual factor	F value	Significance	R^2 value
Aphid	y = 0.1799 X - 1.4287	96	13.7	p < 0.05	0.96
Epilachna beetle	y =-0.3318 X + 6.3864	38	11.3	P < 0.01	0.83
Shoot borer	Y=-0.507 X + 5.2309	39	17.3	P < 0.01	0.39
Pod borer	y=0.3245 X - 2.8224	87	21.3	P < 0.05	0.87

Y, insect population/plot; X, pod per plant (n).

correlation was observed in aphid ($p < 0.05$), pod borer ($p < 0.05$) and ephilachna beetle ($p < 0.01$), shoot borer ($p < 0.01$); respectively. It was evident that the equation y = 0.1799 X - 1.4287; 0.3245 X - 2.8224 gave a good fit to the data and the co-efficient of determination ($R^2 = 0.96$; 0.87) fitted regression line had a significant regression co-efficient. It may be concluded that strong positive correlations were found for the yield (pod numbers) of country bean and the number of both insects of aphid and pod borer i.e., when the yield (pod numbers) of country bean was increased at the same period the number of aphids and pod borers were increased in field. It may be occurred because of insects were found there food availability (pods) and optimum temperature in the field.

In case of epilachna beetle and shoot borer, that the equation y = -0.3318x + 6.3864, -0.507 X + 5.2309 gave a good fit to the data and the co-efficient of determination (R^2= 0.38; 0.39) fitted regression line had a significant regression co-efficient. It may be concluded that strong negative correlations were found between the yield of country bean and the number of both insects of epilachna beetle and shoot borer in natural condition i.e., when the pod numbers of country bean were increased at the same period the number of epilachna beetles and shoot borers were reduced in field. In flax (*Linum usitatissimum* L.) field, the pod borer, aphid, were found as the most common and major insects of flax and this study informed & supported the present finding i.e. the time

of yield increasing, the pod infestation was also found in increasing mode (Pal *et al.* 2017).

It can be concluded that insect pests of country bean and their relationship with the bean pod and temperature is significantly correlated. The abiotic (temperature) and biotic factors (Insect morph & behavior) are more important to develop the insect population of country bean.

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References

FAO. 1988. Production Year Book, Food, Agricultural Organization of the United Nation, Rome Italy. *42:* 190-193.

Hossain MA, Prodhan MZH and Sarkar MA. 2009. Sowing dates: a major factor on the incidence of major insect pests and yield of mung bean. Journal of Agriculture and Rural Development*, 7:* 127-133.

Jayasinghe RC, Premachandra WTSD and Neilson R. 2015. A study on Maruca vitrata infestation of Yard-long beans (Vigna unguiculata subspecies sesquipedalis). *Heliyon*, *1*(1). https://doi.org/10.1016/j.heliyon.2015.e00014

Khan AU, Choudhury MAR, Ferdous J, Islam MS, Rahaman MS. 2019. Varietal performance of selective country beans against ipsect pests in bean agroecosystem. Bangladesh Journal of Entomology, *29:* 27-37.

Khan AU, Choudhury MAR, Islam MS and Maleque MA. 2018. Insect pest community and their fluctuation pattern in country bean agroecosystem. Journal of the Sylhet Agricultural University, *5*: 69-75.

Khan, MMH, Islam MM, Asaduzzaman M and Uddin MN. 2018. Mutants and weather prameters affecting the population dynamics of three major insect pests of mung bean. SAARC Journal of Agriculture, *16:* 1-12.

Mckinlay, RG, Spaull AM and Straub RW. 1992. Pests of solanaceous crops. In: Mckinlay RG (ed.) Vegetable crop pests. McMillan press. Hound Mills, Basingstoke, Hampshire and London. Pp. 263-326.

Nazrul MI and Shaheb MR. 2016. Performance of french bean (*Phaseolus Vulgaris* L.) genotypes in Sylhet region of Bangladesh. Bangladesh Agronomy Journal, *19:* 37-44.

Nitharwal M and Kumawat KC. 2009. Population dynamics of insect pests of green gram, *Vigna radiata* (Linn.) Wilczek in semi-arid region of Rajasthan. Indian Journal of Applied Entomology*, 2:* 90-92.

Pal S, Mandal R, Sarkar I, Ghimiray TS, Sharma BR, Roy A, Roy SK, Chakraboorty G and Mitra S. 2017. Species diversity and community structure of arthropod pests and predators in Flax, (*Linum Usitatissimum* L.) from Darjeeling (India). Biological and Applied Sciences, 60: e17160492 Jan/Dec 2017: 1–9. http://dx.doi.org/10.1590/1678-4324-2017160492.

Shrivastava KM and Singh LN. 1986. A review of the pest complex of kharif pulses in UP. Lens. *28:* 333-335.

Uddin MS, Rahman MM, Alam MZ, Hossain MM and Hoque ME. 2014. Effect of farmers practices for the management of insect pests of yard long bean (*Vigna Unguiculata*). Bangladesh Journal of Agricultural Research, *39:* 173-84.